Notice No.3

Rules and Regulations for the Classification of Naval Ships, January 2018

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: June 2018

Amendments to	Effective date	IACS/IMO implementation (if applicable)
Volume 1, Part 1, Chapter 2, Sections 3 & 7	1 July 2018	N/A
Volume 1, Part 3, Chapter 5, Sections 8 & 10	1 July 2018	N/A
Volume 1, Part 3, Chapter 6, Section 6	1 July 2018	N/A
Volume 1, Part 6, Chapter 4, Section 2	1 July 2018	N/A
Volume 1, Part 6, Chapter 6, Sections 2 & 3	1 July 2018	N/A

Volume 1, Part 1, Chapter 2
Classification Regulations

■ *Section 3*
Character of Classification and Class notations

3.8 Military Distinction notations

(Part only shown)

Table 2.3.1 Hull, Military and Other Class Notations

Mandatory Notations		Other Notations		
Ship Type	Service Area	Hull Strength	Military distinction ✠ MD	Others
				See Vol 1, Pt 1, Ch 2, 3.10 Other notations **DWA** Deep Water Anchoring **PCWBT** Protective Coating in Water Ballast Tanks

(Part only shown)

Table 2.3.2 Machinery Class Notations

Machinery Notations *See Vol 1, Pt 1, Ch 2, 3.9 Machinery and Engineering Systems notations*	
	ICC Integrated Computer Control ~~**IP**~~ ~~Integrated Propulsion~~ **PRM** Provision Refrigeration Machinery

3.9 Machinery and Engineering Systems notations

(Part only shown)

3.9.2 The following class notations are associated with the machinery control and automation, and may be assigned as considered appropriate by the Classification Committee:

~~**IP** This notation may be assigned to a ship classed with LR when the arrangements of the machinery are such that the propulsion equipment and all other machinery for Mobility and/or Ship Type systems, *see Vol 2, Pt 1, Ch 1, 3 Engineering system designation*, is integrated with the power unit for operation under all normal sea-going and manoeuvring conditions. The system is to be bridge controlled and the propulsion equipment is to incorporate an emergency means of propulsion in the event of failure in the prime mover. It also denotes that the machinery and control equipment have been arranged, installed and tested in accordance with LR's Rules.~~

3.10 Other notations

3.10.18 **ENV**. This notation will be assigned where the environmental protection arrangements demonstrate compliance with one or more characters as described in the Rules. Available characters include:

A Anti-fouling coatings;

GW Grey water and sewage;

IHM Inventory of Hhazardous Mmaterials ~~(ship recycling)~~;

MRV Monitoring, reporting and verification of carbon dioxide;

~~**NOx-1**,~~ **NOx-2**, **NOx-3** Emissions of nitrogen oxides;

OW Oily water management;

P Oil tanks in protected locations;

RS Refrigeration systems;

SOx Emissions of sulphur oxides;

UWN Underwater noise.

3.10.21 **PCWBT ~~Protective Coating in Water Ballast Tanks.~~** This notation will be assigned to naval ships, at the Owner's request, when protective coating systems have been applied during construction to ~~indicate that the ship's~~ all sea-water ballast tanks having boundaries formed by the hull envelope in accordance with the *ShipRight Protective Coatings in Water Ballast Tanks* procedure, ~~are coated~~ and that the coating remains efficient and is maintained in good condition.

3.10.22 **ACS ().** This notation will be assigned to ~~N~~naval ships, at the Owner's request, when protective coating systems have been applied during construction in accordance with the *ShipRight Anti-Corrosion Notations* procedure and that the coating remains efficient and is maintained in good condition. The **ACS ()** notation, with the extension of one or more of the following associated supplementary characters shown in brackets, detailing the specified protected area or areas, may be assigned as follows:

B Water Ballast Tanks
V Void Spaces

3.10.26 **DWA** This notation (Deep Water Anchoring) may be assigned to a ship with a Rule length L_R not less than 135 m, subject to the Rules in *Vol 1, Pt 3, Ch 5, 10 Anchoring equipment in deep and unsheltered water*, which has increased equipment for anchoring in deep water with a depth up to 120 m.

■ *Section 7*
Classification of ship with *IWS notation

7.1 General

7.1.2 Where the ***IWS** notation is to be assigned, protection of the underwater portion of the hull is to be provided by means of a suitable high ~~resistant~~ resistance paint applied in accordance with the manufacturer's requirements. Details of the high resistance paint are to be submitted for information in accordance with *Ch 15 Corrosion Prevention* of the Rules for Materials.

7.2 Appraisal and records

(Part only shown)
7.2.1 To facilitate survey and compilation of classification records, the following plans and particulars are to be submitted to LR for appraisal and information.
(c) Details of high ~~resistant~~ resistance paint, for information only.

Volume 1, Part 3, Chapter 5
Anchoring, Mooring, Towing, Berthing, Launching, Recovery and Docking

■ *Section 8*
Anchor windlass design and testing

8.1 General

8.1.1 A windlass or winch ~~of sufficient power and suitable for the size of anchor cable~~ used for handling anchors, suitable for the size of chain cable required by *Vol 1, Pt 3, Ch 5, 5 Anchor cable* and complying with the following criteria is to be fitted ~~to the craft~~. Where Owners require equipment significantly in excess of Rule requirements, it is their responsibility to specify increased windlass power.

~~8.1.2 The windlass seating to be designed to loads no less than the maximum pull developed by the windlass.~~

8.1.2 The design, construction and testing of windlasses are to conform with a relevant National or International Standard or code of practice acceptable to LR. To be considered acceptable, the standard, or code of practice, is to specify criteria for evaluation of stresses, performance and testing.

8.1.3 Operation and maintenance procedures for the anchor windlass are to be incorporated in the vessel operations manual.

8.2 Plans and particulars to be submitted

8.2.1 The following plans showing the design specifications, the standard of compliance, engineering analyses and details of construction, as applicable, are to be submitted for evaluation:
- Windlass design specifications, anchor and chain cable particulars, performance criteria, and standard of compliance.
- Windlass foundation drawings inclusive of the supporting structure below deck. The details shall include bolts, chocks, shear stoppers etc. along with the foot print loads for the specified windlass ratings.
- Chain stopper foundation drawings inclusive of the supporting structure below deck. The details shall include bolts, chocks, shear stoppers etc. along with the foot print loads for the specified rating.

- Windlass arrangement plans showing all the components of the anchoring/mooring system such as the prime mover, shafting, cable lifter, anchors and chain cables; mooring winches, wires and fairleads, if they form part of the windlass machinery; brakes; controls; etc.
- Dimensions, materials, welding details, as applicable, of all torque-transmitting (shafts, gears, clutches, couplings, coupling bolts, etc.) and all load bearing (shaft bearings, cable lifter, sheaves, drums, bed-frames, etc.) components of the windlass and of the winch, where applicable, including brakes, chain stopper (if fitted), and foundation.
- Hydraulic system, to include:
  (i) piping diagram along with system design pressure,
  (ii) safety valves arrangement and settings,
  (iii) material specifications for pipes and equipment,
  (iv) typical pipe joints, as applicable, and
  (v) technical data and details for hydraulic motors.
  (vi) cooling systems arrangements for hydraulic system oil
- Electrical one-line diagram along with cable specification and size, motor controller, protective device rating or setting, as applicable.
- Control, monitoring and instrumentation arrangements.
- Engineering analyses for torque-transmitting and load-bearing components demonstrating their compliance with recognised standards or codes of practice. Analyses for gears are to be in accordance with a recognised standard.
- Calculations proving satisfactory inertia loads for the intended windlass, *see Vol 1, Pt 3, Ch 5, 8.4 Windlass design 8.4.1 (b)*.
- Plans and data for windlass electric motors including associated gears rated 100 kW and over.
- Calculations demonstrating that the windlass prime mover is capable of attaining the hoisting speed, the required continuous duty pull, and the overload capacity are to be submitted if the 'load testing' including 'overload' capacity of the entire windlass unit is not carried out at the shop (*see Pt 3, Ch 5, 8.9 Shop inspection and testing 8.9.1(b)*).

8.3 Materials and fabrication

8.3.1 Materials used in the construction of torque-transmitting and load-bearing parts of windlasses are to comply with LR *Rules for the Manufacture, Testing and Certification of Materials, July 2017, incorporating Notice No. 1 & 2* or an appropriate National or International Standard acceptable to LR, provided that the Standard gives reasonable equivalence to the requirement of LR. The proposed materials are to be indicated in the construction plans and are to be approved in connection with the design. All such materials are to be certified by the material manufacturers and are to be traceable to the manufacturers' certificates.

8.3.2 Weld joint designs are to be shown in the submitted construction plans and are to be appraised in association with the approval of the windlass design in accordance with an appropriate National or International Standard acceptable to LR. .

8.3.3 Welding procedures, welding consumables and welders are to comply with the LR *Rules for the Manufacture, Testing and Certification of Materials, incorporating Notice No. 1 & 2* or an appropriate National or International Standard acceptable to LR.

8.3.4 The degree of non-destructive examination of welds and post-weld heat treatment, if any, are to be specified and submitted for consideration.

~~8.2~~ 8.4 Windlass design

~~8.2.1~~ 8.4.1 In addition to the requirements of the National or International Standard or code of practice acceptable to LR (*see Pt 3, Ch 5, 8.1 General 8.1.2*) ~~The~~ the following performance requirements ~~criteria~~ are to be ~~used as design basis for the windlass~~ complied with:

(a) Holding Loads: Calculations are to be made to show that, in the holding condition (single anchor, brake fully applied and chain cable lifter declutched) and under a load equal to 80 per cent of the specified minimum breaking strength of the chain cable, the maximum stress in each load bearing component will not exceed the maximum permissible yield. For installations fitted with a chain cable stopper, 45 per cent of the specified minimum breaking strength of the chain cable may instead be used for the calculation.

(b) Inertia Loads: The design of the drive train, including prime mover, reduction gears, bearings, clutches, shafts, cable lifter and bolting is to consider the dynamic effects of sudden stopping and starting of the prime mover or chain cable, so as to limit inertial load.

~~(a)~~(c) Continuous Duty Pull: The windlass is to have sufficient power to exert a continuous duty pull, Z_{cont1}, over a period of 30 minutes ~~of~~ corresponding to the grade and diameter, d_c, of the chain cables as follows:

(i) for specified design anchorage depths up to 82,5 m when using ordinary stockless anchors:

Chain cable grade	~~Duty pull, P, in~~ Z_{cont1} (N)
U1	$37{,}5d_C^2$
U2	$42{,}5d_C^2$
U3	$47{,}5d_C^2$

(ii) for specified design anchorage depths greater than 82,5 m a continuous duty pull Z_{cont2} is:

~~$P_1=P+(D_a - 82{,}5)0{,}27d_c^2$~~ $Z_{cont2} = Z_{cont1} + (D_a - 82{,}5) \times 0{,}27d_c^2$ N

~~where d_c is the chain diameter, in mm, D_a is the design anchorage depth, in m, P is the duty pull for anchorage depth up to 82,5 m and P_1 is the duty pull for the anchorage depths greater than 82,5~~

where

d_c = is the chain diameter, in mm

D_a = is the specified design anchorage depth, in metres

The anchor masses are assumed to be the masses as given in Table 5.6.1 Equipment - Kedge anchors and wires, towlines and mooring lines. The value of Zcont is based on the hoisting of one anchor at a time, and also assumes that the effects of buoyancy and hawse pipe efficiency (assumed to be 70 per cent) have been accounted for. In general, stresses in each torque-transmitting component are not to exceed 40 per cent of yield strength (or 0,2 per cent proof stress) of the material under these loading conditions.

~~(b)~~(d) Overload Capability: The windlass prime mover is to ~~have sufficient power to exert,~~ be able to provide, for ~~over~~ a period of at least two minutes, the necessary temporary overload capacity for breaking out the anchor. This temporary overload capacity is to be a pull equal to the greater of:

(i) short term pull:

1,5 times the continuous duty pull as defined in ~~*Ch 10, 3.13 Certification 3.13.2.(b)*~~ *Vol 1, Pt 3, Ch 5, 8.1 Windlass design 8.4.1(c)*, or

(ii) anchor breakout pull:

$$12{,}18W_a + \frac{7{,}0L_c d_c^{\,2}}{100} \quad N$$

where

L_c = is the total length of chain cable on board, in metres, as given by *Table 5.4.1 Equipment – HHP Bower anchors and chain cables*

W = is the mass of bower anchor (kg) as given in *Table 5.4.1 Equipment – HHP Bower anchors and chain cables*.

Note: The speed in this period may be lower than normal.

(e) Hoisting Speed: The mean speed of the chain cable during hoisting of the anchor and cable is to be 0,15 m/s.

~~(c) The windlass, with its braking system in action and in conditions simulating those likely to occur in service, is to be able to withstand, without permanent deformation or brake slip, a load, applied to the cable, given by:~~

~~$K_b d_c^{\,2} (44 - 0{,}08 d_c)$ N~~

~~where~~

~~K_b is given in *Table 5.8.1 Values of K_b*~~

~~Where a chain stopper is fitted, the windlass braking system is only to ensure safe stopping when paying out the anchor and chain. It is the Master's responsibility to ensure that the chain stopper is in use when riding at anchor. At clearly visible locations on the bridge and adjacent to the windlass control position, the following notice is to be displayed:~~

~~'The brake is rated to permit controlled descent of the anchor and chain only. The chain stopper is to be used at all times whilst riding at anchor.'~~

~~The performance criteria are to be verified by means of shop tests in the case of windlasses manufactured on an individual basis. Windlasses manufactured under LR's Type Approval Scheme for Marine Engineering Equipment will not require shop testing on an individual basis.~~

~~Table 5.8.1 Values of K_b~~

~~Cable grade~~	~~K_b~~	
	~~Windlass used in conjunction with chain stopper~~	~~Chain stopper not fitted~~
~~U1~~	~~4,41~~	~~7,85~~
~~U2~~	~~6,18~~	~~11,00~~
~~U3~~	~~8,83~~	~~15,7~~

(f) Brake Capacity: The capacity of the windlass brake is to be sufficient to stop the anchor and chain cable when paying out the chain cable in a controlled manner. Where a chain cable stopper is not fitted, the brake is to produce a torque capable of withstanding a pull equal to 80 per cent of the specified minimum breaking strength of the chain cable without any permanent deformation of strength members and without brake slip. Where a chain cable stopper is fitted, 45 per cent of the breaking strength may instead be applied. The following simplified formula is to be used to calculate the required brake capacity:

$K_b d_c^{\,2} (44 - 0{,}08 d_c)$ N

Where K_b is given in *Table 5.8.1 Values of K_b*.

Table 5.8.1 Values of K_b

	K_b	
Cable grade	Windlass used in conjunction with chain stopper	Chain stopper not fitted
U1	4,41	7,85
U2	6,18	11,0

U3	8,83	15,7

8.4.3 As an alternative to conducting the engineering analyses required by *Pt 3, Ch 5, 8.4 Windlass Design 8.4.2*, approval of the windlass mechanical design can be based on a type test, in which case the testing procedure is to be submitted for consideration.

~~8.2.5~~ 8.4.4 Calculations for torque transmitting components are to be based on 1500 hours of operation with a nominal load spectrum factor of K_m = 1,0. Alternatively, unlimited hours with a nominal load spectrum factor of K_m = 0,8 can be applied.

~~8.2.6 Where the available input torque exceeds the torque required for anchor breakout, torque overload protection is to be fitted.~~

~~8.2.8 The maximum stress from the load cases stated in *Table 5.8.2 Design load cases for the windlass* is not to exceed the limits stated in *Table 5.8.3 Permissible stress for design load cases*.~~

~~Table 5.8.2 Design load cases for the windlass~~

~~Load case~~	~~Condition~~	~~Note~~
~~1~~	~~Continuous pull~~	~~*See Vol 1, Pt 3, Ch 5, 8.2 Windlass design 8.2.1.(a)*~~
~~2~~	~~Overload pull~~	~~*See Vol 1, Pt 3, Ch 5, 8.2 Windlass design 8.2.1.(b)*~~
~~3~~	~~Brake holding load~~	~~*See Vol 1, Pt 3, Ch 5, 8.2 Windlass design 8.2.1.(c)*~~

~~Table 5.8.3 Permissible stress for design load cases~~

~~Stress~~	~~Load case~~	
	~~1 and 2~~	~~3~~
	~~Permissible stress~~	
~~Tension~~	~~0,8 *Y*~~	~~0,9*Y*~~
~~Compression or bending~~	~~0,8 *Y*~~	~~0,9*Y*~~
~~Shear~~	~~0,7 *Y*~~	~~0,7 *Y*~~
~~Combined~~	~~0,85 *Y*~~	~~0,9*Y*~~

~~Note *1.* Where a component is subjected to axial tensile, axial compressive, bending or shear stress, F_e is to be calculated in the normal manner.~~

~~Note *2.* Where a component is subjected to a combination of co-existent stresses, F_e is the combined stress which is to be calculated as follows:~~

~~= Combined bending and tension~~

~~$F_e = 1{,}25f_t + f_{bt}$~~

~~= Combined bending and compression~~

~~$F_e = f_c + f_{bc}$~~

~~= Combined bending, tension and shear~~

~~=~~ $$F_c = \sqrt{(1,25f_t + f_{bt})^2 + 3f_q^2}$$

~~= Combined bending, compression and shear~~

~~=~~ $$F_c = \sqrt{(f_c + f_{bc})^2 + 3f_q^2}$$

~~= where~~

~~F_e is the calculated stress~~

~~f_t is the calculated axial tensile stress~~

~~f_c is the calculated axial compressive stress~~

~~f_{bt} is the calculated maximum tensile stress due to bending about both principal axes~~

~~f_{bc} is the calculated maximum compressive stress due to bending about both principal axes~~

~~f_q is the calculated shear stress~~

~~Y is the specified 0,2 per cent proof stress for the material~~

~~8.2.9~~ 8.4.5 The following criteria are to be used for gearing design:

(a) Torque is to be based on the performance criteria specified in *Vol 1, Pt 3, Ch 5, ~~8.2~~ 8.4 Windlass design ~~8.2.1~~ 8.4.1*.

(b) The use of an equivalent torque, T_{eq}, for dynamic strength calculations is acceptable but the derivation is to be submitted to LR for consideration.

(c) The application factor for dynamic strength calculation, K_A, is to be 1,15.

(d) Calculations are to be based on 1500 hours of operation.

(e) The static torque is to be 1,5 x T_n where T_n is the nominal torque.

(f) The minimum factors of safety for load capacity of spur and helical gears, as derived using ISO 6336 or a relevant National or International standard acceptable to LR, are to be 1,5 for bending stress and 0,6 for contact stress.

Gears intended to transmit power greater than 100kW are to be certified by LR, the gears are to meet the requirements of *Vol 2, Pt 3 Ch 1 Gearing*.

~~8.2.10 Keyways are to be designed to a relevant National or International Standard acceptable to LR.~~

~~8.2.11 The maximum stress in brake components is not to exceed the permissible stress stated in *Table 5.8.3 Permissible stress for design load cases*.~~

8.5 Additional requirements for windlass design for naval ships

~~8.2.3~~ 8.5.1 Hand-operated ~~winches~~ windlasses are only acceptable if the effort required at the handle does not exceed 150N for raising one anchor at a speed of not less than 2 m/min and making about thirty turns of the handle per minute.

~~8.2.4~~ 8.5.2 ~~Winches~~ Windlasses suitable for operation by hand as well as by external power are to be so constructed that the power drive cannot activate the hand drive.

8.5.3 Where a chain stopper is fitted, the windlass braking system is only to ensure safe stopping when paying out the anchor and chain. It is the Master's responsibility to ensure that the chain stopper is in use when riding at anchor. At clearly visible locations on the bridge and adjacent to the windlass control position, the following notice is to be displayed:
"The brake is rated to permit controlled descent of the anchor and chain only. The chain stopper is to be used at all times whilst riding at anchor"

~~**8.4 Maintenance arrangements**~~

~~8.4.1 Access is to be provided for inspection of reduction gears, bearings, brakes, etc.~~

~~8.4.2 Accessible manual lubrication points, including nipples, are to be provided for both for oil and grease, as applicable.~~

~~8.4.3 Gear-boxes are to be provided with adequate access arrangements for monitoring and replacing oil.~~

8.6 Hydraulic systems

8.6.1 Hydraulic systems where employed for driving windlasses are to comply with the requirements of *Vol 2, Pt 7, Ch 5, 11 Hydraulic power actuating systems.*

8.7 Electrical systems

8.7.1 Electric motors are to meet the requirements of *Vol 2, Pt 9, Ch 3, 9 Rotating machines – general requirements and motors*. Motors exposed to weather are to have enclosures suitable for their location, *see also Vol 2, Pt 9, Ch 1, 2.2 Design, construction and location 2.2.10*.

8.7.2 Motor branch circuits are to be protected in accordance with the applicable Rules and cable sizing is to be in accordance with the requirements of the *Vol 2, Pt 9, Ch 3, 8 Electric cables, optical fibre cables and busbar trunking systems (busways).*

Existing sub-Section 8.3 has been renumbered 8.8.

~~8.5~~ 8.9 Protection arrangements

Existing paragraphs 8.5.1 to 8.5.4 have been renumbered 8.9.1 to 8.9.4.

8.9.5 Electrical cables installed in exposed locations on open deck are to be provided with effective mechanical protection.

8.9.6 Means are to be provided to contain potential debris resulting from severe damage of the prime mover due to over-speed in the event of uncontrolled rendering of the cable, particularly when an axial piston type hydraulic motor forms the prime mover.

~~8.2.7~~ 8.9.7 An arrangement to release the anchor and chain in the event of windlass power failure is to be provided. Windlasses are to be fitted with couplings which are capable of disengaging between the cable lifter and the drive shaft. Hydraulically or electrically operated couplings are to be capable of being disengaged manually.

~~8.1.7~~ 8.9.8 The design of the windlass is to be such that the following requirements or equivalent arrangements will minimise the probability of the chain locker or forecastle being flooded in bad weather:

(g) a weathertight connection can be made between the windlass bedplate, or its equivalent, and the upper end of the chain pipe, by means of cover or seal.

(b) access to the chain pipe is adequate to permit the fitting of a cover or seal, of sufficient strength and proper design, over the chain pipe while the ship is at sea.

8.10 Shop inspection and testing

8.10.1 Windlasses are to be inspected during fabrication at the manufacturers' facilities by a Surveyor for conformance with the approved plans. Acceptance tests, as specified in the specified Standard (*see Vol 1, Pt 3, Ch 5, 8.1 General 8.1.2*), are to be witnessed by the Surveyor and include the following tests, as a minimum:

(a) No-load test. The windlass is to be run without load at nominal speed in each direction for a total of 30 minutes. If the windlass is provided with a gear change, an additional run in each direction for 5 minutes at each gear change is required.

(b) Load test. The windlass is to be tested to verify that the continuous duty pull, overload capacity and hoisting speed as specified in *Vol 1, Pt 3, Ch 5, 8.4 Windlass design 8.4.1* can be achieved.

Where the manufacturing works does not have adequate facilities, these tests, including the adjustment of the overload protection, can be carried out on board ship. In these cases, functional testing in the manufacturer's works is to be performed under no-load conditions.

(c) Brake capacity test. The holding power of the brake is to be verified through testing if not verified by calculation.

~~8.2.2~~ 8.10.2 Windlass performance characteristics specified in ~~*Vol 1, Pt 3, Ch 5, 8.2 Windlass design 8.2.2* and *Vol 1, Pt 3, Ch 5, 8.7 Testing and acceptance 8.7.2*~~ *Vol 1, Pt 3, Ch 5, 8.10 Shop inspection and testing 8.10.1* are based on the following assumptions:

(a) one cable lifter only is connected to the drive shaft;

(b) continuous duty and short term pulls are measured at the cable lifter;

~~(c) brake tests are carried out with the brakes fully applied and the cable lifter declutched;~~

~~(d) the probability of declutching a cable lifter from the motor with its brake in the off position is minimised;~~

~~(e)~~(c) hawse pipe efficiency assumed to be 70 per cent.

~~8.7~~ 8.11 ~~Tests and trials~~ On-board testing

~~8.7.1 Where shop testing is not possible and Type Approval has not been obtained, calculations demonstrating compliance with *Pt 3, Ch 5, 8.2 Windlass design 8.2.1* are to be submitted together with detailed plans and an arrangement plan showing the following components:~~

- ~~Shafting.~~
- ~~Gearing.~~
- ~~Brakes.~~
- ~~Clutches.~~

8.11.1 Each windlass is to be tested under working conditions after installation on board to demonstrate satisfactory operation. Each unit is to be independently tested for braking, clutch functioning, lowering and hoisting of the chain cable and anchor, proper riding of the chain over the cable lifter, proper transit of the chain through the hawse pipe and the chain pipe, and effecting proper stowage of the chain and the anchor. It is to be confirmed that anchors properly seat in the stored position and that chain stoppers function as designed, if fitted. The braking capacity is to be tested by intermittently paying out and holding the chain cable by means of the application of the brake.

~~8.7.2~~ 8.11. 2 During trials on board ship, the windlass is to be shown to be capable of:

~~(a) for all specified design anchorage depths: raising the anchor from a depth of 82,5 m to a depth of 27,5 m at a mean speed of 9 m/min; and~~

~~(b) for specified design anchorage depths greater than 82,5 m: in addition to (a), raising the anchor from the specified design anchorage depth to a depth of 82,5 m at a mean speed of 3 m/min.~~

The mean hoisting speed, as specified in *Vol 1, Pt 3, Ch 5, 8.4 Windlass design 8.4.1 (e)* is to be measured and verified. For testing purposes, the speed is to be measured over two shots of chain cable and initially with at least three shots of chain (82.5 m or 45 fathoms in length) and the anchor submerged and hanging free. ~~Following trials, the ship will be eligible to be assigned a descriptive note **specified design anchorage depth . . . metres**, which will be entered in column 6 of the *Register Book*.~~

8.11.3 Load testing is to be carried out if this was not previously completed as required by *Vol 1, Pt 3, Ch 5, 8.9 Shop inspection and testing 8.9.1 (b).*

8.11.4 Where the depth of water in the trial area is inadequate, suitable equivalent simulating conditions will be considered as an alternative.

~~8.6~~ 8.12 Marking and identification

~~8.6.1 Controls are to be permanently marked for identification, unless their functions are readily apparent. If required, instructions are to be permanently marked and readily visible.~~

8.12.1 The windlass is to be permanently marked with the following information:
(a) Nominal size of the cable chain including mean diameter, grade and percentage of the breaking load the windlass is designed to hold. (E.g. 100/3/45)
(b) Maximum anchorage depth, in metres.

Existing sub-Sections 8.8 and 8.9 have been renumbered 8.13 and 8.14.

■ *Section 10*
Anchoring equipment in deep and unsheltered water

10.1 General

10.1.1 It is recommended that the equipment requirements specified in this Section are complied with if the vessel intends to anchor in deep and unsheltered water. Where a ship's anchoring equipment complies with the requirements of this Section, the ship will be eligible to be assigned the notation **DWA**.

Volume 1, Part 3, Chapter 6
Structural Procedures for the Design, Construction and Lifetime Care of Ships

■ Section 6
Protective Coatings

6.1 General

6.1.1 ~~It is recommended for all ship types that all~~ All salt-water spaces having boundaries formed by the hull envelope are to have a corrosion protection coating applied. *See Vol 1, Pt 6, Ch 6, 3 Corrosion Protection.*

6.1.2 It is recommended that consideration also be given to the effective corrosion protection of other internal spaces ~~and external areas~~ by the use of a suitable protective coating system.

6.2 Protective Coating in Water Ballast Tanks ~~—~~PCWBT notation

6.2.1 ~~If the Owner so wishes, a~~ The ~~notation, **PCWBT** '~~Protective Coating in Water Ballast Tanks~~',~~ notation, **PCWBT**, will be assigned to naval ships, at the Owner's request, when protective coating systems have been applied to water ballast tanks during construction, in accordance with the *ShipRight Protective Coatings in Water Ballast Tanks (PCWBT)* procedure. ~~be entered in the *Register Book* to indicate that the ship's water ballast tanks are coated and that the coating remains efficient and well maintained. If the coatings have broken down, particularly at more critical areas, and no effort is being made to maintain the coatings, then this notation will be placed in parentheses, i.e. (**PCWBT**). In either case the date of the last survey will be placed in parentheses after the notation.~~

6.2.2 The notation will continue to be assigned provided that the coatings remain efficient and are maintained in good condition; however, if the coatings have broken down, particularly at more critical areas, and no effort is being made to maintain the coatings, then the notation will be placed in parentheses, i.e. (**PCWBT**), and the date of the last survey will be placed in parentheses after the notation.

6.3 ~~**ShipRight**~~ Anti-Corrosion System ACS () notation~~s~~

6.3.1 The Anti-Corrosion System notation, ~~**ShipRight**~~ **ACS (B) and/or ACS (V)**, will be assigned to ~~N~~naval ships ~~vessels~~, at the Owner's request, when protective coating systems have been applied to water ballast tanks or void spaces during construction, in accordance with the *ShipRight Anti-Corrosion System Notations ~~for Naval Ships~~ procedure*.

6.3.2 The notation will continue to be assigned provided that the coatings remain efficient and are maintained in good condition; however, if the coatings have broken down, particularly at more critical areas, and no effort is being made to maintain the coatings, then the notation will be placed in parentheses, i.e. (**ACS (B,V)**), and the date of the last survey will be placed in parentheses after the notation.

~~6.3.2~~ 6.3.3 The ~~notation **ShipRight**~~ **ACS (B)** notation also indicates that the protective coating systems for water ballast tanks has been applied in accordance with IMO regulations; however, it is only available to new-build ships. The **PCWBT** notation may be applied to existing ships when in compliance with the applicable ~~provisions~~ *ShipRight Procedure*.

Volume 1, Part 6, Chapter 4
Hull Girder Strength

■ *Section 2*
Hull girder strength

2.3 Shear strength

2.3.1 The shear strength of ~~the~~ all ships is to satisfy the requirements given in this Section.

2.3.2 Generally, the shear strength is to be assessed in accordance with *Vol 1, Pt 6, Ch 4, 2.3 Shear strength 2.3.6*. Alternatively the shear strength can be assessed using shear flow in association with the maximum permissible shear stress, τ_p, given in *Vol 1, Pt 6, Ch 4, 2.3 Shear strength 2.3.6*.

2.3.3 ~~2.3.2~~ For ships with large openings in the side shell and/or a complex arrangement of longitudinal bulkheads and decks is proposed, shear flow calculations or direct calculation may be required.

2.3.4 ~~2.3.3~~ Where shear flow calculation procedures other than those available within ShipRight are employed, the requirements of ~~*Vol 1, Pt 6, Ch 3, 14 Strengthening for bottom slamming*~~ *Vol 1, Pt 6, Ch 3, 1.4 Equivalents* are to be complied with.

Existing paragraphs 2.3.4 to 2.3.7 have been renumbered 2.3.5 to 2.3.8.

Volume 1, Part 6, Chapter 6
Material and Welding Requirements

■ *Section 2*
Materials

Existing sub-Sections 2.6 to 2.10 have been deleted.

■ Section 3
Corrosion protection

3.1 General

3.1.1 All steelwork is to be suitably protected against corrosion by a suitable protective coating. All coatings are to be in accordance with the requirements of this Section.

3.1.2 Where the **PCWBT, ACS (B)** or **ACS (V)** notations have been assigned, the requirements of *Vol 1, Pt 3, Ch 6, 6 Protective Coatings* are to be complied with.

3.1.3 At the time of new construction, all salt-water ballast spaces having boundaries formed by the hull envelope shall have an efficient protective coating, epoxy or equivalent, applied in accordance with the manufacturer's recommendations, *see Ch 15 Corrosion Prevention* of the Rules for Materials.

3.1.4 For ships that are required to comply with IMO Resolution MSC.215(82) - *Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-Side Skin Spaces of Bulk Carriers - (Adopted on 8 December 2006)*, all dedicated sea-water ballast tanks are to comply with all the requirements of the Resolution, *see Ch 15 Corrosion Prevention* of the Rules for Materials.

3.1.5 Details and recommendations regarding protective coatings are given in LR's *List of Paints, Resins, Reinforcements and Associated Materials*.

3.1.6 Integral tanks that contain only fuel can be coated or, where applicable, be protected by a system of cathodic protection or both, *see Vol 1, Pt 6, Ch 6, 3.4 Internal Cathodic Protection*.

3.1.7 Steelwork is to be suitably cleaned and cleared of mill scale before the application of any coating.

3.1.8 Paints or other coatings are to be suitable for the intended purpose in the locations where they are to be used. Coatings are to be of adequate film thickness, applied in accordance with the paint manufacturer's specification.

3.1.9 The paint or coating applied is to be compatible with any previously applied primer.

3.1.10 Paint containing more than 10 per cent aluminium by weight in the dry film should not, in general, be used in positions where oil or fuel vapours can accumulate, unless it has been shown by appropriate tests that the paint to be used does not increase the incendive sparking hazard.

3.1.11 Paints, varnishes and similar preparations having a nitrocellulose or other highly flammable base are not to be used in accommodation or machinery spaces.

3.2 Prefabrication primers

3.2.1 Prefabrication primers are to be approved in accordance with *Ch 15 Corrosion Prevention* of the Rules for Materials.

3.3 External hull protection

3.3.1 External hull surfaces are to be protected from corrosion by the use of appropriate anti-corrosive measures, which can include the application of suitable coating systems to all external surfaces.

3.3.2 Details of coating systems are to be submitted in accordance with *Ch 15 Corrosion Prevention* of the Rules for Materials.

3.3.3 Where a cathodic protection system is fitted, plans showing the proposed layout of anodes and hull penetrations are to be submitted in accordance with *Ch 15 Corrosion Prevention* of the Rules for Materials.

3.3.4 The arrangements for glands, where cables pass through the shell, are to include a small cofferdam. Cables to anodes are not to be led through tanks intended for the carriage of low flash point oils. Where cables are led through cofferdams or ballast tanks located in hazardous areas, *see Vol 2, Pt 9, Ch 5, Hazardous Areas*, they are to be enclosed in a substantial steel tube of at least 10 mm thickness.

3.3.5 Where an ***IWS** (In-Water Survey) notation is to be assigned (*see also Vol 1, Pt 1, Ch. 2, 7 Classification of ships with *IWS notation*), protection of the underwater portion of the hull is to be provided by means of a suitable high resistance paint applied in accordance with the manufacturer's requirements. Details of the high resistance paint are to be submitted for information in accordance with *Ch 15 Corrosion Prevention* of the Rules for Materials.

3.4 Internal hull protection

3.4.1 The requirements for cathodic protection of internal tanks in *Ch 15 Corrosion Prevention* of the Rules for Materials are to be complied with.

3.4.2 When a cathodic protection system is to be fitted in tanks for the carriage of liquid with flash point not exceeding 60°C, a plan showing details of the locations and attachment of anodes is to be submitted. The arrangements will be considered for safety against fire and explosion aspects only. Impressed current cathodic protection systems are not permitted in any tank.

3.4.3 Particular attention is to be given to the locations of anodes in relation to the structural arrangements and openings of the tank.

3.4.4 Anodes are to be of approved design and sufficiently rigid to avoid resonance in the anode support. Steel cores are to be fitted, and these are to be so designed as to retain the anode even when the latter is wasted.

3.4.5 Anodes are to be attached to the structure in such a way that they remain secure, both initially and during service. The following methods of attachment are acceptable:

(a) Steel core connected to the structure by continuous welding of adequate section.
(b) Steel core bolted to separate supports, provided that a minimum of two bolts with lock nuts are used at each support. The separate supports are to be connected to the structure by continuous welding of adequate section.
(c) Approved means of mechanical clamping.

3.4.6 Anodes are to be attached to stiffeners, or are to be aligned in way of stiffeners on plane bulkhead plating, but they are not to be attached to the shell. The two ends are not to be attached to separate members which are capable of relative movement.

3.4.7 When locating anodes, care is to be taken to ensure that they do not cause a stress concentration. Where cores or supports are welded to the main structure, they are to be kept clear of the toes of brackets and similar stress raisers. Where they are welded to asymmetrical stiffeners, they are to be connected to the web with the welding kept at least 25 mm away from the edge of the web. In the case of stiffeners or girders with symmetrical face plates, the connection shall be made to the web or to the centreline of the face plate but well clear of the free edges. However, it is recommended that anodes not be fitted to face plates of higher tensile steel longitudinals.

3.5 Aluminium and magnesium anodes

3.5.1 Aluminium and aluminium alloy anodes are permitted in tanks which can contain explosive or flammable vapour, or in tanks adjacent to tanks which can contain explosive or flammable vapour, but only at locations where the potential energy of the anode does not exceed 275 J. The weight of the anode is to be taken as the weight at the time of fitting, including any inserts and fitting devices. The height of the anode is, in general, to be measured from the bottom of the tank to the centre of the anode. Where the anode is located on a horizontal surface (such as a bulkhead stringer) not less than 1 m wide, provided with an upstanding flange or face plate projecting not less than 75 mm above the horizontal surface, the height of the anode can be measured above that surface.

3.5.2 Aluminium anodes are not to be located under tank hatches unless protected by adjacent structure.

3.5.3 Magnesium and magnesium alloy anodes are not permitted in tanks which can contain explosive or flammable vapour, or in tanks adjacent to tanks which can contain explosive or flammable vapour. Where permitted for other tanks, adequate venting must be provided.

3.6 Bimetallic connections

3.6.1 The design shall ensure that the location of all bimetallic connections allows for regular inspection and maintenance of the joints and penetrations during service.

3.6.2 Where bimetallic connections are made involving dissimilar metals, measures are to be incorporated to mitigate galvanic corrosion.

3.6.3 Special attention is to be given to the penetrations of and connections to the hull, bulkheads and decks by piping and equipment where dissimilar materials are involved.

3.7 Deck coverings

3.7.1 The steel deck is to be coated with a suitable material in order to prevent corrosive action, and the sheathing or composition is to be effectively secured to the deck.

3.7.2 Deck coverings within accommodation spaces, control stations, stairways and passageways are to be of a type which will not readily ignite or cause smoke or toxic or explosive hazards at elevated temperatures in accordance with the requirements of the *International Code for the Application of Fire Test Procedures or Naval Administration*.

3.7.3 Where plated decks are sheathed with wood or an approved composition, reductions in plate thickness may be allowed.

3.8 Corrosion margin

3.8.1 The scantlings determined from the formulae provided in the Rules assume that the materials used are selected, manufactured and protected in such a way that there is negligible loss in strength due to corrosion.

3.8.2 Where steel is not protected against corrosion by painting or other approved means, the scantlings may require to be further considered.

3.8.3 For naval vessels with scantlings in accordance with either the *Rules and Regulations for the Classification of Ships, July 2017, incorporating Notice No. 1, 2, 3 & 4* **NS(SR)** or the *Rules and Regulations for the Classification of Special Service Craft, July 2017, incorporating Notice No.1,2,3,4 & 5* **NS(SSC)**, the corrosion margins, where specified in those Rules, are to be applied.

3.8.4 It is the responsibility of the Owner to specify corrosion margins which meet their operational requirements. Where the Owner does not specify corrosion margins, it is recommended that corrosion margins be applied to net scantlings calculated by these Rules in areas of the ship's structure where corrosion or wear is expected to occur in service. The following recommendations are offered as guidance:

+0,5 mm all hull envelope plating below a line, 1,0 m above the design waterline

+0,5 mm of all plating forming the boundary of tanks

+0,5 mm plating forming the lower boundary of wet spaces as appropriate

+2,0 mm to the keel plate

+1,5 mm to flight deck plating.

Consideration should also be given to the addition of a corrosion margin in the following areas:

- the lower portion of stiffeners located within wet spaces;
- stiffeners located within tanks;
- all tanks containing corrosive fluids and areas where spillage of corrosive fluids could occur;
- the base of mast structures;
- all uncoated structures.

3.8.5 Where a corrosion margin is specified, these are to clearly shown on the submitted plans in accordance with *Vol 1, Pt 6, Ch 1, 2.2 Plans to be submitted 2.2.1*.

Existing Sections 3 to 6 have been renumbered 4 to 7.

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Published by Lloyd's Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom

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